

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

The non-woven web may be made by a single individual process or by adapting a continuous manufacturing process, such as paper making. In both cases the fibres (long and short) are dispersed in solution, preferably water, to form a slurry. Also added to the slurry are one or more polymers (the "first polymer"), preferably hydrophilic polymers, for example polyvinylalcohol (PVA). The first polymer may be in the form of fibres. Once the long and short fibres and the first polymer are uniformly dispersed in the liquid, the liquid is either drained in the case of a single individual process or the fibres are formed into a continuous structure by the controlled deposition of the slurry onto a moving bed mesh. In such a wet laid process, the longer fibres, which exceed the thickness of the final structure typically by at least an order of magnitude, are pulled down by the water flow during the filtration process to lie in the x-y plane. Because of the density of fibres, as each layer deposits, the longer fibres span across a number of other fibres, thus generally maintaining the x-y orientation. The short fibres, being generally of a similar length or shorter than the thickness of the final web, tend to be pulled by the water flow into the interstices of the web, formed by the longer fibres, but do not tend to span more than one of the longer fibres. Thus there is much greater z-directionality of the shorter fibres. The web so-formed is dried in an oven, and if necessary placed in a solution of the final polymer, which may or may not be the same as the first polymer, allowed to dry and subsequently heat treated to set the final polymer, if used, or to set the first polymer. If it is not desirable for the first polymer to remain in the final web structure, it may be removed by this heat treatment or by an alternative appropriate process. In addition, any undesirable residues may be removed by the heat treatment or by an alternative appropriate process.

IN THE CLAIMS:

1 1. (Amended) A non-woven fibre web comprising a plurality of
2 longer fibres in the x- and y-directions of average length greater than 5mm (~~“longer~~
3 ~~fibres”~~) and a plurality of shorter fibres of average length less than 3mm (~~“shorter~~
4 ~~fibres”~~) wherein at least a proportion of the shorter fibres ~~of average length less~~
5 ~~than 3mm~~ are orientated in the z-direction, and wherein the ~~proportion~~ plurality of
6 shorter fibres ~~of average length less than 3mm~~ is at least 20% of the total weight of
7 fibres, and wherein the density of the non-woven fibre web is from 0.1g/cm³ to
8 0.35g/cm³.

1 2. (Amended) A non-woven fibre web comprising up to and
2 including 80% by weight of longer fibres in the x- and y-directions of average
3 length greater than 5mm (~~“longer fibres”~~), and 20% or more by weight of shorter
4 fibres of average length less than 3mm (~~“shorter fibres”~~) wherein at least a
5 proportion of the shorter fibres ~~of average length of less than 3mm~~ are orientated in
6 the z-direction, and wherein the density of the non-woven fibre web is from
7 0.1g/cm³ to 0.35g/cm³.

1 3. (Amended) A non-woven fibre web according to claim 1 ~~or~~
2 ~~claim 2~~ wherein the ~~proportion~~ plurality of shorter fibres is ~~suitably~~ no more than
3 85% by weight of total fibres in the substrate.

1 4. (Amended) A non-woven fibre web according to claim 3
2 wherein the ~~proportion~~ plurality of shorter fibres is ~~suitably~~ no more than 70% by
3 weight of the total fibres.

1 5. (Amended) A non-woven fibre web according to ~~any of~~
2 ~~claims 1 to 4~~ claim 1 or 2 wherein the longer fibres ~~suitably~~ have a maximum
3 average length of 50mm.

1 6. (Amended) A non-woven fibre web according to claim 5
2 wherein the longer fibres are of average length of 5mm to 30mm.

1 7. (Amended) A non-woven fibre web according to ~~any~~
2 ~~preceding~~ claim 1 or 2 wherein the shorter fibres are of average length less than
3 2mm.

1 9. (Amended) A non-woven fibre web according to ~~any~~
2 preceding claim 1 or 2 wherein the shorter fibres have an average minimum length
3 of 50µm.

1 10. (Amended) A non-woven fibre web according to ~~any~~
2 preceding claim 1 or 2 wherein the longer fibres and shorter fibres are
3 independently selected from the group consisting of carbon, glass, silica, polymer,
4 metal and ceramic fibres.

1 12. (Amended) A non-woven fibre web according to ~~any~~
2 preceding claim 1 or 2 wherein the density of the non-woven fibre web is from
3 0.1g/cm³ to 0.2g/cm³.

1 13. (Amended) A process for the preparation of a non-woven
2 fibre web according to ~~any preceding claim 1~~, said process comprising the steps of:

3 (i) dispersing the longer and shorter fibres in solution to form a
4 slurry;

5 (ii) adding at least one or more polymers (the "first polymer")
6 polymer to the slurry;

7 (iii) draining the liquid from the slurry to form a web, or forming
8 a continuous structure by the controlled deposition of the
9 slurry onto a moving bed mesh;

10 (iv) drying the web;

11 (v) optionally placing the web in a solution of a final polymer
12 (the "final polymer") and drying the web; and

13 ~~(vi) — drying the web; and~~

14 ~~(vii)~~ vi) heat treating the web.

1 14. (Amended) A gas diffusion substrate comprising a non-
2 woven substrate comprising a non-woven fibre web as claimed in ~~any one of claims~~
3 ~~1 to 12~~ claim 1 or 2, and a filler material.

1 16. (Amended) A gas diffusion substrate according to claim 14
2 ~~or claim 15~~ wherein the filler material comprises a catalyst material.

1 17. (Amended) A gas diffusion electrode comprising a gas
2 diffusion substrate as claimed in ~~any one of claims 14, 15 and 16~~ claim 1 or 2, and
3 an electrocatalyst material.

1 20. (Amended) A membrane electrode assembly comprising a
2 gas diffusion electrode as claimed in ~~any one of claims 17, 18 and 19~~ claim 17, a
3 second gas diffusion electrode ~~which may or may not be an electrode as claimed in~~
4 ~~any one of claim 17, 18 and 19~~, and a solid polymer membrane.

1 21. (Amended) A membrane electrode assembly comprising a
2 gas diffusion electrode as claimed in ~~any one of claims 17, 18 and 19~~ claim 17, a
3 gas diffusion substrate ~~which may or may not be a substrate as claimed in any one~~
4 ~~of claims 14, 15 and 16~~, and a solid polymer membrane, wherein an electrocatalyst
5 layer is applied to the side of the membrane facing the gas diffusion substrate.

1 22. (Amended) A membrane electrode assembly comprising a
2 gas diffusion substrate as claimed in ~~any one of claims 14, 15 and 16~~ claim 14, a
3 gas diffusion electrode ~~which may or may not be an electrode as claimed in any one~~
4 ~~of claims 17, 18 and 19~~, and a solid polymer membrane, wherein an electrocatalyst
5 layer is applied to the side of the membrane facing the gas diffusion substrate.

1 23. (Amended) A membrane electrode assembly comprising a
2 gas diffusion substrate as claimed in ~~any one of 14, 15 and 16~~ claim 14, and a
3 second gas diffusion substrate ~~which may or may not be a substrate as claimed in~~
4 ~~any one of claims 14, 15 and 16~~, and a solid polymer membrane, wherein an
5 electrocatalyst layer is applied to both sides of the solid polymer membrane.

For filing

1 24. (Amended) A fuel cell comprising a gas diffusion substrate
2 as claimed in ~~any one of claims 14, 15 and 16~~ claim 14.

1 25. (Amended) A fuel cell comprising a gas diffusion electrode
2 as claimed in ~~any one of claims 17, 18 and 19~~ claim 17.